to keep the surface wet. Thus, when the rainy season comes to an end, there is a large body of underground water to support the growth of plants, especially of trees which require water late in the season, and to sustain the flow of springs and other sources of water for irrigation. It would, therefore, be a very great advantage to Palestine if the winters were a few degrees colder, so that snow fell more abundantly and stayed longer than now, and if the rainy season were a little longer, so that there would be less danger of drought in the critical seasons of fall planting and spring growth.

In the following pages it must be borne in mind that it is a change of this sort which is postulated. One writer compares the climate of ancient Palestine to that of England to-day. Such a comparison is misleading. It involves a complete change in the regimen of the seasons. If the climate of Palestine during historic times were ever different from what it is to-day, it probably resembled that which would now prevail along the Ægean coast of Asia Minor if the relief of the land and its relation to the sea were like those of Syria.

(To be continued.)

THE HUMAN SIDE OF SYSTEMATIC GEOGRAPHY.

BY

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The scientific study of any complex subject in its varied branches depends on the recognition of two fundamental principles: first, the determination of the scope of the subject, and, second, the adoption of some logical method of treatment. In the case of geography, at the present time, the scope of the subject is admittedly the study of the earth in its relation to life. By this definition geography is made to cover the entire field of studying and analyzing every type of land form and the way in which each type controls, modifies, or prohibits entirely animal and plant life in that region. Theoretically, these two correlated aspects of earth study stand on exactly the same plane, neither being subordinate to the other. If either aspect may be said to outweigh the other, a strict interpretation of the definition would seem to make the life element the important point, since earth study becomes geography only when it is considered *in its relation to life*. Taking man as typical of life in general, the definition might

be restated to read: geography is the study of the earth as a dwelling-place for man.

Looking at the question from different points of view, different writers emphasize quite diverse phases of the subject. The usual text-book of geography makes the land forms most prominent and subordinates all life relations, the extreme of this type being represented by the "physiographers" who make their subject essentially synonymous with dynamic geology. A biologist, on the other hand, lays most stress on distribution and adaptation of species, just as the economist and historian put forward the items which appeal most strongly to their particular interests. The Shenandoah Valley, for example, appeals to the physiographer as an excellent illustration of a valley developed in a folded mountain region during the second or third cycle of erosion, and his interest lies in the dynamic processes by which that valley was produced. The biologist regards the same valley from the standpoint of the different plant species which are found farther north in the valley than they are on the adjoining mountain sides, or perhaps as a line along which insect species have spread. The economist sees in it the greater productivity per acre because of the fertile limestone soils and favourable climate; while the historian considers the valley as a highway for the advancement of colonial settlements, or as a factor in the Civil War and especially in the Battle of Gettysburg. Widely diverse as these different attitudes are, they are all a part of the great field of geography and they all strive toward the same end: the interpretation of the earth on which man lives, with the relationships existing between surface conditions and the varied forms of life. It is rare, however, to find these closely correlated responses so associated one with another as to show all the ways in which a valley may be an important controlling factor. In short, the scope of geography is recognized clearly enough, but in reality the life element, even the human side of the life element, is relegated to a distinctly secondary consideration.

The second fundamental principle of scientific study is that of logical treatment according to some system in which common characteristics are taken as a basis of classification. The disputed status of systematic geography need not be argued here. It is sufficient to recognize the fact that, in the case of dealing with land forms, at least, practically every one makes use of some sort of system of classification. The designation *systematic geography* is in common use, but in many ways the name is inexact; systematic physiography would more nearly cover the usual meaning which lies back of the term. The truth of this statement can be seen from the fact that the

systems of classification are invariably based solely on physical characters of land forms, and where used at all they are almost entirely limited to this single phase of the subject. The consideration of life relations is almost invariably made a minor consideration, consisting of hardly more than a few general suggestions, despite the fact that to the average student the study of geography increases in interest and value with increased emphasis on the human side.

The usual scheme of classification in systematic geography rests on a twofold basis: first, a division into classes on the basis of rock structure; and, second, a subdivision of the classes on the basis of the varying amounts of erosion which have modified similar structures to different degrees. According to such a system, land forms in general fall into three broad classes depending on increasing complexity of geological structure. These three classes, plains, plateaus, and mountains, are then subdivided into young, mature, and old, according to the stage of erosion. Occasionally, as in the case of belted coastal plains, and almost always in detailed regional studies, it becomes necessary to add rock texture as a basis for still further subdivision, since varying texture is an important factor in determining the minor forms resulting from erosion. Such a system carries out a definite correlation of one class with another, and of any one member of a class of land forms with all other members of the same class. Thus a plateau in central Asia can at once be directly compared with a plateau in the eastern United States merely by stating in what respects each one diverges from the type plateau. Such a classification, broad enough to include every type of land form known to exist, is easily formulated, and from its application to land forms alone has arisen the appellation systematic geography.

Geography, however, includes not one phase alone, but the two coördinate phases: types of environment, and responses of life to these types—two elements on an absolutely equal footing. But the only logical systems of classification thus far formulated depend solely on dynamical geology bases. Hence, when a classification of life responses to environment is attempted, the existing systems are found to hold good in some cases and not good in others. For example, certain similarities in the types of mountain life found almost everywhere can be readily grouped under the simple head of mountains. Then, to speak of a mountainous region will in most cases suggest hardy mountaineers, difficulties of travel, tendencies toward clannishness among the people, isolation from the outside world, and, hence, scanty population. It would be necessary, however, to make many exceptions from the general conditions, if the discussion of life

in mountains is to be made complete; as, for example, in the case of the tropical portions of South America, with its large cities and denser populations characteristically located in the elevated and mountainous districts. Yet this example of man's response to his environment is not in any way an exception; on the contrary, it is exactly what would have to be expected both there and elsewhere under the same conditions, if all the important factors in environment were taken into consideration.

In short, the system of classification which is satisfactory for land forms is inadequate when it is applied to the grouping together of all life responses in their proper relations and with provisions made for the many types of responses which are clearly recognized. The complication arises from the fact that the earth's surface,—land and water,—does not constitute the whole environment. Any system of treatment based solely on these considerations must fall short by just the amount that land and water fail to constitute the whole environment. A third factor, more important than both the others in this controlling influence over life, is found in the atmosphere, a part of the earth as truly as the ocean is a part of the earth. Hence, the atmosphere, with its different phenomena, is necessarily to be considered in the study of the earth in its relation to life. Give a region every possible advantage of surface form and position, but deprive it of beneficial warmth or sufficient rain, and the question of life in that region is quite different from what it would be with both heat and moisture. Too much heat or too much moisture will again produce an entirely distinct series of results. It is manifestly impossible, therefore, to advance very far in a systematic analysis of the human phase of geography, if the physiographic basis of classification is followed strictly. The world as a whole is now fairly well known in so far as physical characteristics are concerned, and the different types have found their appropriate places among land forms in general. The interpretation of these areas from a geographic basis is the sort of work which must become most prominent in the future.

The need for a systematic classification which shall be fitted for this human side of geography becomes increasingly urgent, if the whole subject is to be reduced to a logical correlated study rather than degenerate into mere descriptions of individual cases by themselves. The problem of framing a satisfactory classification of this sort is more complex than formulating a system for the grouping of land forms. The classification for human responses cannot well be separated from the different types of land forms, since surface condition alone prompts many responses, such as freedom of travel over plains,

or the location of towns at the junction of two important valleys. The new classification, therefore, must begin with the existing scheme as supplying a basis for certain general relations, and from that go on to add new bases of division in order to provide for the grouping of all the important phases of environmental control. This union of the physiographic classification with another scheme based on other controlling influences will permit a more detailed grouping of human responses, and bring forward relations which have not been made prominent heretofore. In fact, it seems not unlikely that the real neglect or disjointed treatment of the human side of geography in otherwise highly satisfactory texts has been due largely to the adherence to the strictly physiographic bases of classification, in which only the broadest generalization regarding human influences can be accommodated.

The important additional element to be considered is the control exerted by atmospheric conditions, or climate, since areas similar in surface forms may differ greatly in this very important respect. In the study of physiography alone there is little place for the consideration of climatic effects, since their importance in the modification of land forms is minor rather than major. In the study of life responses to environment, however, the consideration of climate cannot be avoided if the analysis of cause and effect is to be at all complete. Under most conditions, in fact, climate is probably more important than any other single factor, though, as in mountains, the climate may be directly controlled by land form. Climate, however, is an average of many conditions, in which average one strikingly variable element may be more important than the combined effect of all the other elements in determining life controls. Yet in using climate alone this significant variation would not appear to be prominent. It becomes necessary, therefore, to introduce into the discussion the effect of special climatic factors and controls in order to bring together the proper cause and its results. Thus the *campos* of Brazil owe their special characteristics not to the fact that they are plains, nor to the fact that they are plains in the tropical zone; but to the particular association of plains, tropical zone, and a distinct division of the year into a wet and a dry season in that zone. On the other hand, *prairies* in the United States, *tundras* in Siberia, and, in fact, other plains in the tropical zone itself, may resemble the Brazilian *campos* in every superficial aspect, with entirely different results in the essential controls of life. These differences have long been recognized,—in fact, in one way or another, they usually receive some sort of mention in the average text,—but they are not

presented together; the force of contrast disappears and the whole striking lesson of geographic control and result is lost. It is evidently desirable, then, to have a basis of subdivision on which plains of the campos type with their life controls may be differentiated from plains typified by the prairies of the United States and from the Siberian tundras. On the physiographic basis they would all be classed together because of their geological structure or stage of erosion; whereas, the control of life by special climatic factors, in which they differ widely, is no less important than that of the plain surface. The climatic factors and controls which in general stand out most prominently in affecting life are temperature, rainfall, and wind; latitude, altitude, and distribution of land and water. Each one of these elements must at times be used to give the correct explanation of observed conditions, and by their use, *along with* the different types of surface form, geography becomes in truth the study of the earth in relation to life.

The application of this system to the human side of geography can be readily illustrated by taking plains as an example. The classification of plains as land forms remains unaltered with the introduction of the climatic element since the mere surface forms vary but little between regions of different climates. The conditions of life on plains, however, are no longer grouped as one great whole or taken in their broad similarities with endless exceptions and special items to be described separately. Starting with the chapter heading *Plains,* it then appears that the most satisfactory subdivisions are to be made on the basis of temperature and rainfall, since these two elements are the primary controls in the distribution of plant and animal types on which human life so closely depends.

Such a grouping would be made as follows:

Plains—three classes:

(A) Tropical—3 sub-types.
(1) Humid. (2) Semi-arid. (3) Arid or desert.

(B) Temperate—3 sub-types.
(1) Humid. (2) Semi-arid. (3) Arid or desert.

(C) Polar—1 sub-type.
(1) Frozen.

The elaboration of this system can be carried into great detail by introducing more specific bases of divisions; as, for instance, seasonal distribution of rainfall in humid plains, or trade wind and mountain barrier influence on deserts. To illustrate the way in which such a classification facilitates ready comparison of different life elements

in plains, tropical and temperate regions may be contrasted with respect to certain important characteristics:

General title—Plains:

(A) Tropical plains—no distinct change of season as far as temperature is concerned. Mean annual temperature, 68° F. or over.

1.—Humid tropical plains—rainfall 30 inches or over. Abundant vegetation—tropical species.

1. (a) Humid at all times, vegetation of jungle type; certain valuable vegetable products; population mainly low native; travel difficult; unhealthful fevers.

1. (b) Humid one season; *i.e.,* wet and dry seasons of year. Vegetation grassy, few or no trees; population higher types, farmers and cattle raisers; travel easy in dry season.

2.—Semi-arid tropical plains—rainfall 15-30 inches. Scanty vegetation—forest absent; travel easy.

2. (a) Irrigable — agriculture; permanent settlements.

2. (b) Non-irrigable—grassy only. Agriculture not possible. Sparse population. Grazing; great ranges for cattle. Semi-nomad native.

3.—Arid or desert tropical plains—rainfall under 15 inches. Vegetation of desert type, spiny or fleshy; travel difficult; small nomad tribes—robber types. Streams intermittent; irrigation from underground sources only.

3. (a) Oases—agriculture; fruit trees; cross roads of travel—oasis cities.

(B) Temperate plains—warm summers; cool or cold winters. Mean temperature of summer not less than 43° F.

1.—Humid temperate plains—rainfall 30 inches or over. Abundant vegetation—temperate species.

1. (a) Humid at all seasons. Forests usual—originally. Dense population and most advanced civilization; extensive agriculture—grains; travel easy; healthful.

1. (b) Humid at one season. Forests scanty. Agriculture—special crops; *e. g.,* winter wheat; live-stock grazing—mainly cattle.

2.—Semi-arid temperate plains—rainfall 15-30 inches. Vegetation grassy, special forage crops and grain species; forests absent.

2. (a) Irrigable—agriculture.

2. (b) Non-irrigable—grazing only—largely sheep. Winter ranges bad—separate ranges for two seasons.

3.—Arid or desert temperate plains—rainfall under 15 inches. Desert type of vegetation.

3. (a) Irrigable from mountain streams. Development possible.

It might be claimed that the divisions used here are arbitrarily made, but each one is based on natural controls. The division between tropical and temperate plains on the basis of seasonal change corresponds to the distribution of important plant species, such as the palm, for example. In the difference of Nature's bounty in vegetation which coincides with the distribution of the palm species is found a vast series of responses on the part of man. The subdivision on the basis of rainfall finds justification in the fact that twenty inches of rainfall corresponds more or less closely to the dividing line between possible and impossible tillage crops; a dividing line which also marks distinctly different conditions of human life. The introduction of the semi-arid sub-type removes much of the objection which might arise if a hard and fast separation were made on the twenty-inch basis. It is impossible to avoid some measure of arbitrary separation in the same way, as it is impossible to draw any but an arbitrary line of demarcation between plains and plateaus. No one ventures to say just what the line of division shall be in that case, any more than one ventures to say how much tilting of the strata must take place before a broken plateau would pass into a region of block mountains.

Such a classification as is here outlined can be applied in the same way to the other large groups of land forms by adopting the appropriate bases of subdivision. If need be, to include types not readily placed here, further grouping can be readily made, as, for instance, the use of altitude as an added basis for grouping tropical plains, since altitude is there an important factor.

The observance of these additional elements in systematic geog-

raphy makes it far easier to present the whole interrelationship of earth and life both from the standpoint of being able to include all important life controls in their proper places, and also from the standpoint of giving a definite correlated idea of the whole. This latter very desirable object is impossible where the classic treatment is adhered to; that is, where the grouping of land forms is made simply on the basis of geological characteristics, and the atmosphere with its results is treated separately. The effect of climatic conditions on the life in plains is different from the effect of climatic conditions in mountains, but in each case it is a very essential part of the environment, and a logical geographical treatment should make the types of earth environment into complete entities. Not until surface forms and climatic conditions are regarded as making single definite units and are studied as such, can geography attain its highest development and become, in fact as well as in definition, the study of the earth in its relations to life.

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STATE GEOLOGICAL SURVEYS AND PRACTICAL GEOGRAPHY.*

BY

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The expression "practical geography," as used in this paper, implies, not essentially the utilitarian or economic phase of the subject, but the rational as opposed to the idealistic, the possible as opposed to the highly improbable or impossible. What we could accomplish in the way of right geography, and what, as a matter of fact, we are able to accomplish in the near future, are disproportionate quantities. But we do not desire the idealist to become less active; he is the standard-bearer, and when at some future time this country shall have attained the position in geography even now reached in England, we may grant that the man who always advocated the very best did more than half the work. In the meantime, it may not be futile to point out some lines of activity possible for Geological Surveys, organizations already well established and sustained in many of the States. Not only these organizations, but many others, both State and national, are constantly producing much matter that is

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